The temporal dynamics of ambivalence: Changes in positive and negative affect in relation to consumption of an “emotionally charged” food

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Ambivalence is thought to impact consumption of food, alcohol and drugs, possibly via influences on craving, with cravers often being simultaneously drawn toward and repelled from ingestion. So far, little is known about the temporal dynamics of ambivalence, especially as it varies in relationship to consumption. Participants (n = 482, 56.8% female) completed the Positive and Negative Affect Schedule prior to, immediately and 30 min after the opportunity to eat a bar of chocolate. Affective ambivalence was calculated based on the relative strengths of and discrepancy between ratings of positive and negative affect. Ambivalence peaked prior to a decision about consumption and subsequently decreased, whether or not the decision was in favor of or against consuming. Decreasing ambivalence was driven by a drop in positive affect over time; positivity decreased more rapidly in those who consumed chocolate. Findings represent a first step in characterizing the dynamics of ambivalence in interactions with a target stimulus.

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1. Introduction and background

Ambivalence is defined as the “degree to which an attitude object is evaluated positively and negatively at the same time” (Jonas, Broemer, & Diehl, 2000). Ambivalence can be based on cognitive (i.e. “mixed beliefs”), affective (i.e. “torn feelings”), or cognitive/affective conflicts (i.e. incongruent feelings and beliefs) (Thompson, Zanna, & Griffin, 1995). Ambivalence has been hypothesized to influence ingestive behaviors, and specifically play a role in the etiology of cravings for ingested substances such as food, alcohol and drugs of abuse. This hypothesis is based on the observation that individuals who experience a craving tend to be simultaneously drawn toward and repelled from consumption (Breier, Stritzke, & Lang, 1999; Cartwright & Stritzke, 2008). Chocolate, the most commonly craved food among women in the United States (Rozin, Levine, & Stoess, 1991), is one example of a substance thought to be a potent trigger of ambivalence because it is simultaneously appealing in its sensory properties, and repelling in its unwanted effects on body weight and the stigma associated with unrestrained overindulgence (Cartwright & Stritzke, 2008; Macdiarmid & Hetherington, 1995; Rogers & Smit, 2000). It has been proposed that ambivalence plays a direct role in the etiology of craving for chocolate in that craving represents “the net action disposition, arising from the interplay of simultaneous and competing inclinations to approach and to avoid chocolate” (Cartwright & Stritzke, 2008).

Though ambivalence has been presumed to impact eating, drinking and substance use, so far there has been little empirical data to support this assumption. This study sought to assess ambivalence as it may vary in relationship to actual consumption of an emotionally charged substance. It was hypothesized that affective ambivalence and the underlying positive and negative dimensions of affect would change dynamically in the anticipation of and following consumption of chocolate.

2. Materials and methods

Participants were 482 undergraduate students (56.8%, n = 274 female; Mage = 18.67 and SD = 1.15) taking part in a study presented as an investigation of “the effects of consuming chocolate on memory and concentration.” The study was conducted in class as part of an introductory psychology course as a way of exposing students to the idea of a clinical trial; all methods were approved by the Institutional Review Board at the University of Pennsylvania. The study was carried out in consecutive meetings of two sections of the same class, each with 200–300 students in attendance.

Participants were handed an 8" X 11" envelope containing a single-serving (40 to 50 g, depending on the type of chocolate given) bar of white, dark, or milk chocolate and asked to follow the instructions given in the enclosed written materials and by the instructor. Participants completed a consent form, indicated basic demographic information, gave baseline ratings of their liking of different types of chocolate (on a scale of 0 = “not at all” to 100 = “extremely”), and self-identified as chocolate cravers or non-cravers. They were then given 5 min to eat as much or as little of the bar as they wished.
Positive and negative affect were assessed at three time points: prior to, immediately after, and 30 min following the opportunity to consume the chocolate, using the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). Participants were asked to indicate how they felt “right now” by rating the 20 items on the PANAS using a scale of “1 = very slightly or not at all” to “5 = extremely.” The 1 to 5 scores were summed to yield totals ranging from 10 to 50 for the ten positive affect adjectives, and −10 to −50 for the negative adjectives. Affective ambivalence was calculated at each of the three time points using the formula \[ \text{Affective ambivalence} = \frac{(A_p + -A_n)}{2} \], where \( A_p \) represents the mean rating of the ten PANAS items assessing positive affect and \( A_n \) represents the mean rating of negative affect (Kaplan, 1972).

With positive and negative affect rated on +/−10 to +/−50 scales, this yielded ambivalence ranging from 20 = “no ambivalence” to 100 = “extreme ambivalence.” Affective ambivalence has been calculated in prior studies using coder-rated positive and negative mood scores, derived from respondent narratives (Amabile, Barsade, Mueller, & Staw, 2005); use of the PANAS here was an attempt to derive affective ambivalence scores in a similar manner, but using more objective ratings of affect. Hunger and appetite for sweet and savory foods, rated on scales ranging from 0 = “not at all” to 100 = “as hungry as I have ever been/as strong as my appetite has ever been,” were also assessed at three time points, along with ambivalence.

3. Results

Fifty-two participants (10.8% overall, 12.8% of women and 7.7% of men, \( \chi^2 = 3.09, \text{and } p = 0.10 \)) chose not to consume any chocolate. These participants gave significantly lower baseline ratings of their current hunger, current appetite for both sweet and savory foods, and liking for milk, dark, and white chocolate, and indicated significantly less time since they had last eaten a meal (all \( p < 0.05 \)). They did not differ from those who consumed chocolate in likelihood of self-identifying as a chocolate craver (50.0% of non-eaters versus 61.2% of chocolate eaters; \( \chi^2 = 2.35 \) and \( p = 0.08 \)). There were no significant differences on any measures between those who consumed white, milk or dark chocolate; therefore the three groups were combined in all analyses.

A mixed between-within subjects analysis of variance (ANOVA) was conducted to explore the impact of time (time points 1, 2, and 3), gender (female/male) and chocolate consumption (yes/no) on levels of affective ambivalence. There was a significant main effect of time on levels of affective ambivalence \[ F(2,417) = 11.62, \text{with } p < 0.001, \text{and partial } \eta^2 = 0.05 \], with ambivalence decreasing over the course of the study (M\(_{time 1} = 29.54, SD = 9.14 \) versus M\(_{time 2} = 28.39, SD = 9.12 \) versus M\(_{time 3} = 26.63, SD = 7.95 \); Fig. 1). There were no statistically significant main effects of gender or chocolate consumption, and no significant interactions.

Mixed between-within subjects ANOVAs looking separately at ratings of positive and negative affect used to calculate ambivalence scores revealed significant main effects of time \[ F(1,438) = 56.97, \text{with } p < 0.001, \text{and partial } \eta^2 = 0.12 \] and chocolate consumption \[ F(1,438) = 17.28, \text{with } p < 0.001, \text{and partial } \eta^2 = 0.04 \].

Looking at the rates of change (i.e. slopes) in positive and negative affect over time, there was a significant main effect of chocolate consumption on rates of change of positive affect \[ F(1,418) = 8.46, \text{with } p = 0.004, \text{and partial } \eta^2 = 0.02 \text{for time 1 to 2, and } F(1,418) = 12.75, \text{with } p < 0.001, \text{and partial } \eta^2 = 0.03 \text{for time 2 to 3; no effect for time 1 to 3}. \]

Self-report of positive affect decreased at a significantly higher rate in those who consumed chocolate [time point 1 to 2: Mslope = 4.17, SD = 3.50 versus Mslope = 2.69, SD = 2.07 and time point 2 to 3: Mslope = 5.34, SD = 4.30 versus Mslope = 2.84, SD = 2.48], compared to those who did not eat any chocolate. There was a significant main effect of gender on rates of change of negative affect from time point 1 to 3 \[ F(1,418) = 4.77, \text{with } p = 0.003, \text{and partial } \eta^2 = 0.01 \], with negative affect decreasing at a significantly greater rate in women (Mslope = 4.16 and SD = 3.42), compared to men (Mslope = 3.20 and SD = 1.70).

In individuals consuming any chocolate affective ambivalence at time point 1, prior to consumption, was significantly and inversely related to the amount of chocolate consumed (\( r = -0.10 \) and \( p = 0.04 \)). There was no significant association between ambivalence and consumption at time points 2 or 3. Affective ambivalence was significantly and positively correlated with self-reported appetite for something sweet in participants who consumed chocolate at all time points (\( r = 0.79 \), \( r = 0.69 \) and \( r = 0.20 \), respectively; all \( p < 0.001 \)), but not in those who did not eat any chocolate. There were no significant differences between self-identified chocolate cravers and non-cravers in affective ambivalence at any time point.

4. Discussion

Findings presented here represent a first step in exploring the dynamics of affective ambivalence with regard to food. They specifically shed light on temporal changes in levels of ambivalence, and associations between ambivalence, craving and intake.

In spite of some weaknesses in the experimental design – most notably the non-random assignment to the control group of not consuming chocolate and the close spatial proximity between those eating and not eating chocolate – the present study yields some interesting and novel information about the temporal dynamics of ambivalence. As had been hypothesized, levels of ambivalence fluctuate significantly with changing interactions with the target stimulus – in this case a bar of chocolate. Affective ambivalence was at its highest level when participants were faced with the stimulus, but prior to their making a decision about consumption versus abstention. Ambivalence declined with increasing temporal distance from the point of decision-making, whether or not that decision was in favor of

![Fig. 1. Self-reported ambivalence, positive and negative affect at three time points (immediately pre-, post- and 30 min after consumption) in individuals eating versus those not eating chocolate.](image)
consumption or abstinence. This suggests that in the interaction with an emotionally charged stimulus, a conflict between approach and avoidance is most pronounced immediately before choosing a behavioral outcome, regardless of whether or not that decision entails actually consuming the substance.

The overall decrease in affective ambivalence over time appeared to be driven primarily by a decrease in levels of positive affect, while negative affect stayed fairly constant. Of note, positive affect decreased more rapidly in those participants who had consumed chocolate, suggesting that the positive appeal – but not the negativity – of chocolate is primarily in the anticipation of or involvement in, rather than in the consequences of consumption. It has been suggested previously that eating chocolate may lead to increases in positive affect (Hill & Heaton-Brown, 1994), but also that any boost in positive affect is likely to be short-lived (Parker, Parker, & Brotchie, 2006), and may be accompanied by simultaneous increases in negative affect, driven by enhanced guilt after consumption (Macht & Dettmer, 2006). The present findings are consistent with assumptions about the temporal dynamics of positive affect in-so-far as we observe a short-lived increase in positive affect prior to or during initial consumption, with a subsequent decline in levels of positivity. The relative stability of negative affect observed here should be interpreted somewhat cautiously since participants were given a choice about consumption and those who anticipated an increase in negative affect – such as feelings of guilt – may have chosen to avoid this by not eating any chocolate.

In those who eventually decided in favor of consuming chocolate, ambivalence prior to making a decision about consumption was inversely related to the amount of chocolate eaten subsequently. This is counter to the hypothesis that there is a positive relationship between ambivalence and intake. In this context it should be noted that respondents in this study reported overall low levels of ambivalence to chocolate; it is recommended that the relationship between incongruent affect and intake be explored further in a sample of respondents high in ambivalence.

Self-identified status as chocolate-craver was unrelated to ambivalence, which is inconsistent with prior assumptions about ambivalence playing an integral role in craving. It is possible that this is due to the fact that “craving” was assessed here as a trait variable, when ambivalence may in fact relate primarily to state craving. The fact that “appetite for something sweet” – which could be considered a proxy for state craving – was correlated significantly with ambivalence at all three time points supports this hypothesis. Finding with regard to a link between ambivalence, craving and consumption should be evaluated further.

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Contributors

Authors JMH and PR designed the study and wrote the protocol. JMH conducted the statistical analysis and wrote the first draft of the manuscript. Both authors contributed to and have approved the final manuscript.

Conflict of Interest

Both authors declare that they have no conflicts of interest.

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